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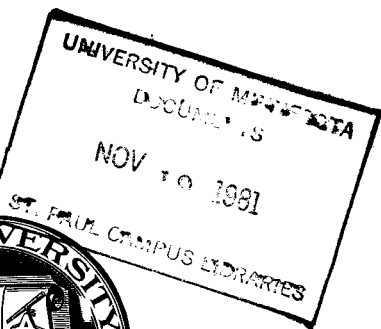
BULLETIN 150

TOBACCO-GROWING IN MINNESOTA

BY

C. P. BULL

DIVISION OF AGRONOMY AND FARM MANAGEMENT



UNIVERSITY FARM, ST. PAUL

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SUMMARY

1. Tobacco has been grown in Minnesota for home use and for market for several years. The production for market has been confined to the southeastern part of the state.
2. The quality and the quantity per acre are essentially the same as reported for Wisconsin; the quantity produced varies according to the variety, the soil, the season, and the attention given by the grower. The lowest and highest yields were 755 and 2,100 pounds per acre, respectively.
3. Minnesota tobacco is recognized as filler and binder grade, tho an appreciable amount of wrapper grade may be found. Connecticut Havana is the best variety for Minnesota conditions.
4. The state aid for tobacco investigations has stimulated the industry and the effort to grow the crop in all parts of the state. The investigations indicate that tobacco may be successfully grown in restricted sections of northern Minnesota where sandy and sandy-loam soils prevail. It is difficult to dispose of the crop unless at least one carload can be delivered to a given shipping point. The interest and the acreage have increased gradually from year to year.
5. Hail, wind, insects, and diseases, as well as carelessness in handling, all tend to make the crop unprofitable. Thus far the profit from Minnesota farms has averaged well—\$165.88 per acre is the highest gross income and 15 cents the highest price per pound received.
6. The cost of producing the tobacco crop varies chiefly with the experience of the grower, the value of the land, and the acreage involved. The results obtained show a wide range—from \$45 per acre to about \$25.
7. The culture of the tobacco crop, from seed bed to market, demands care and attention to many details.
8. The curing shed and other equipment can be used for other purposes.
9. The seed bed should be located within a short distance of water and buildings in order to receive constant care and not cause unnecessary waste of time and labor. It should be protected from wind and open to the sun's rays.
10. An even sowing of the seed in the bed is necessary to the uniformity of growth of the seedlings.
11. A well-prepared soil enhances the success of transplanting and insures better growth of the crop. Medium-sized plants are preferred to small or very large ones. Late afternoon or evening

- transplanting will give best results. Just before a rain or when it is cloudy is also a good time to transplant.
12. The cultivation of tobacco, as that of corn, should be shallow—hoeing at least once will be found necessary.
 13. Topping the plants just at the right time is important. Hence the necessity of going through the field at a time when most plants may be topped. This will tend to cause greater uniformity in ripening.
 14. The grower must be constantly on the watch for disease and insect pests. A few days' delay in treatment may cause serious damage or loss.
 15. Harvesting must begin as soon as the plants are ready. Strict attention to details is necessary to a good product.
 16. After curing the tobacco in the shed the grower must be alert and take advantage of the casing weather to get the crop stripped, baled, and marketed at the first opportunity.

TOBACCO-GROWING IN MINNESOTA

BY C. P. BULL

INTRODUCTION

The growing of tobacco in commercial quantities in Minnesota has never been seriously considered, although in restricted localities it has been successfully grown for several years. Farmers of the south-eastern part of the state have learned of the culture of tobacco from growers across the Mississippi River, in Wisconsin, where it has long been a commercial crop. In fact, Wisconsin is regarded as one of the prominent tobacco-growing states in the Union and now produces annually about 50,740,000 pounds of a quality popularly regarded as "binder" and "filler." Wisconsin's crop has a farm value of \$6,089,000. The average yield per acre in Wisconsin in 1913 was 1,180 pounds, which was within 100 pounds of the average for the last decade. The average price per pound for the last decade was 8.6 cents; thus the average gross returns per acre approximate \$100.¹

As people are prone to think in comparative terms, one naturally estimates the relative possibility of Minnesota becoming a tobacco-growing state. It must be remembered that at present the largest part of Wisconsin's tobacco-growing area lies south of Minnesota's southern line. This fact, however, is no indication of what can be done toward successfully producing the crop in this state.

The growing of "homestead" tobacco for home use has for many years been practiced by certain farmers in nearly every locality. The older men of Scandinavian, German, Austrian, Bohemian, and Polish nativity still persist in the custom. The users of smoking tobacco say that this "homestead" product is exceedingly strong, and can be endured only by those hardened to its use. This feature is not without remedy. The fault lies not in the leaf, but in its curing or treatment after harvest. The method of curing the leaf has an important effect on the quality of the finished product; the casing, sorting, baling, and sweating of the leaf to produce the best flavor and burning qualities are each more or less of an art. The subsequent mixing of fillers and the use of wrapper and binder leaf in making cigars are best understood by those engaged as experts in the manufacturing, or the few who have made it a close study.

¹ From the Yearbook U. S. Dept. of Agr. 1913.

In the preparation of the material embodied in this report and in the directions for tobacco culture the author has had the assistance and collaboration of Chas. H. Lien, who has been field agent in the tobacco-production investigations since 1910. Acknowledgments are also due E. Heibel, J. S. Gillette, Lin and Puls, and other farmers of Sherburne County for their coöperation in gathering the data necessary to ascertain the cost of production and to a practical analysis of the production of tobacco in Minnesota. To T. J. Horton, Station photographer, is due credit for a large number of the photographs.



Fig. 1. A Typical Tobacco Field. Some Plants Saved for Seed Supply

ESTABLISHING INVESTIGATIONS

The legislature of 1909, upon the strength of evidence submitted in favor of tobacco-growing in Minnesota, appropriated \$4,000 for the biennium, to be used by the Department of Agriculture of the State University in investigating tobacco-production in Sherburne County. Each succeeding legislature has renewed the appropriation, but the clause restricting investigation to Sherburne County has been removed.

In June, 1909, Clarence Dale, of Forest Home, Wisconsin, was employed as field man. Coöperation was secured with a farmer who had had some experience in raising plants, and about fifteen farmers in the vicinity of Clear Lake obtained seed or plants and raised a crop under the direction of the field man. The following year Charles Lien was employed as field assistant to succeed Mr. Dale. Each season since

has brought increased interest in the crop, and a better understanding of its culture. The demands for assistance increased so rapidly that it became necessary for those who had had one or more years' work with the crop, to rely more and more upon their own experience, and correspondingly less upon assistance from the field man. New growers were encouraged and assisted each year until a large number of farmers have been made familiar with the requirements for growing the crop.

MINNESOTA GRADES OF TOBACCO

The grades of tobacco leaves are based upon the specific use to which they are put, with reference to their consumption and their relative physical appearance. This generally constitutes the basis upon which the grower sorts his crop when preparing it for baling and mar-

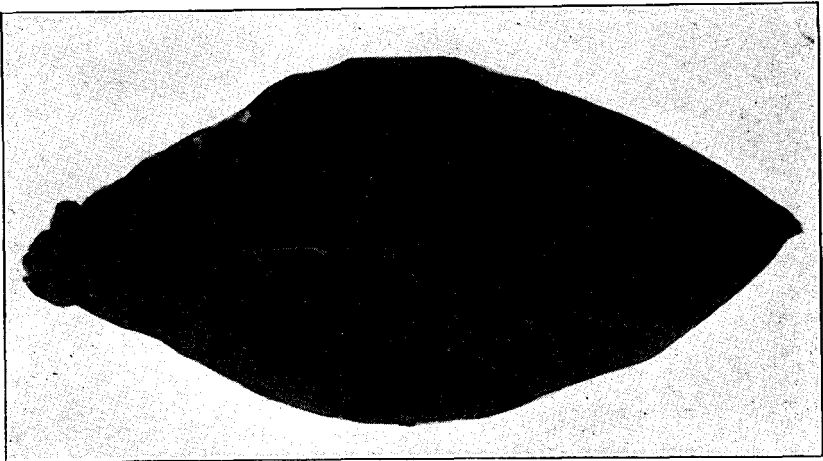


Fig. 2. A Typical Leaf of Minnesota Connecticut Havana Tobacco
Broad, perfect, uninjured leaves of this character are desirable.

keting. The tobacco warehouses and manufacturers subject the leaves to a further test and assorting, before the merchant manufacturer receives it. This primarily consists of a test of its burning quality, its texture, its general appearance, and the size of leaf. For the purpose of this bulletin, only the former grades need be considered.

The grower should seek to produce a long, broad leaf of thin or fine texture, which, when pulled gently between the fingers, presents an oily, lustrous surface. The leaves should be free from holes or disease spots, as well as otherwise clean. Care in the selection of varieties and seed stock, as well as in all the crop cultural work, is an important factor in the production of a high-grade product. The general reference to a certain grade as wrappers is understood to mean

the individual leaf. Cigar-making involves the use of three grades, fillers, binders, and wrappers. Filler is that portion of the cigar which gives it body or bulk. It is generally the ragged and otherwise poor leaves picked from the lower and upper portion of the plants. These leaves are also prepared as so-called smoking tobacco.

It does not as yet pay the inexperienced grower in Minnesota to separate the leaves into more than the fillers and binders, as the amount and price would not pay for a more extensive classification.

PROGRESS OF THE INDUSTRY

Following the feeble beginning of tobacco-growing in 1909, the farmers of Sherburne and adjoining counties watched its development with eager anticipation. Report blanks were sent to 178 parties

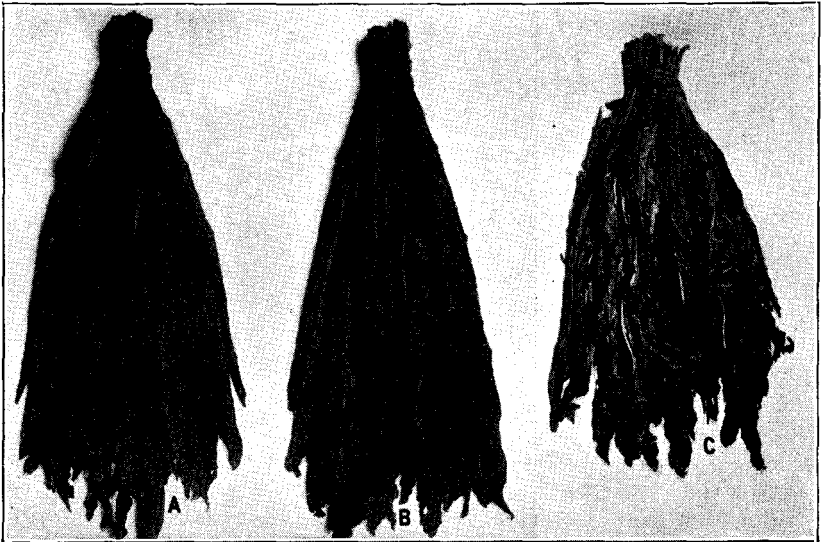


Fig. 3. "Hands" of Tobacco Leaves Showing the Different Grades

- A. Wrappers—a grade Minnesota is not supposed to produce.
- B. Binders and fillers—the recognized product of Minnesota. These with "imported" wrappers are said to produce the best results from the use of domestic leaf.
- C. Fillers and smoking—mostly the latter because of damaged leaves.

to whom seed or plants and instructions were furnished in 1909, that some idea of the adaptability of the crop to Minnesota conditions could be gained. Responses from 47 who grew plants were received from 30 counties, covering all except the northwestern part of the state. In every instance the success of the trial was reported as promising, altho one from Lac qui Parle County reported it could not profitably be grown. The grade of the harvested crop was, with one exception,

reported as good. The crop grown at Poplar, Cass County, was damaged by hail. Seven had sold or had some on hand for sale. Fifteen cents was the highest price received for the product and six cents, the lowest. These were reported from Wadena, Meeker, and Sherburne counties, respectively. Several stated that the leaves were saved for home use. The others, for miscellaneous reasons, had not decided what to do or had not harvested the plants, or had neglected to fill in the report. This preliminary but much scattered series of tests is encouraging, as far as showing the possibility of raising tobacco in Minnesota is concerned. The majority of the reports were from parties inexperienced in tobacco-growing. It is therefore safe to assume that with experience much better results could be accomplished. The following is a copy of the blank sent out:

TOBACCO INVESTIGATIONS

University Farm, St. Paul, Minn., Feb. 8, 1910

Mr....., P. O....., Co.....Minnesota
Dear Sir:

Last year (1909) we furnished you with.....seed..... of Minnesota-grown, Connecticut Havana tobacco. The Experiment Station is desirous of obtaining a report of your success with the crop, together with any other thoughts you may be willing to add to this report. The Station is trying to determine the possibilities of tobacco culture in Minnesota, and to assist in the development of the industry if it proves, in any measure, successful in an experimental way. Circulars giving instructions in preparing the seed bed, transplanting, cultivating, harvesting, curing, etc., are now available. Those wishing them should address Section of Agronomy, University Farm, St. Paul, Minn. We invite your cooperation and request an answer to the following questions:

1. How much land had you in tobacco?.....
2. What distance apart did you set the plants?.....
3. What is the character of your soil?.....
4. How did you prepare the soil?.....
5. From the standpoint of growth, was the crop promising?.....
6. How did you handle the crop at harvest time?.....
7. How did you cure the crop?.....
8. Did you sell the crop?..... At what price?.....
9. Do you think tobacco can be profitably grown in your neighborhood?.....
10. Have you any tobacco now for sale?..... How much?.....
11. Have you made any attempt to sell it?.....
12. If so, what has been the result?.....
13. What grade of tobacco did you succeed in harvesting?.....
14. What else can you say about the subject?.....

Yours truly,

Associate Agriculturist

WORK OF 1910

In the spring of 1910, 27 farmers desired to grow tobacco and requested assistance and instruction in the best methods of culture. The combined area devoted to the crop was approximately 40 acres. The largest two fields were 6 and 9 acres respectively. Altho most of the acreage centered about Clear Lake, in Sherburne County, the growers extended north and east into Palmer and Santiago townships; one

grower being 15 miles away. Mr. Lien made regular trips to these 27 growers during the entire season, giving in each case personal instructions and demonstrations in the art of seeding, transplanting, topping, and the other steps in the culture and care of the crop. In addition to this, assistance was given by others during the rush seasons of seeding, planting, and harvesting, as it was impossible for Mr. Lien to be at all places on the same day.

Table I gives in detail the results obtained by those who raised a sufficient amount to be noted and who marketed the crop. Tobacco buyers came to Clear Lake and inspected some of the crops, agreed to buy within a given range of prices, and authorized the field agent to receive the shipment and bill out the car for them. Accordingly 15 growers delivered 19,959 pounds of baled tobacco, which brought

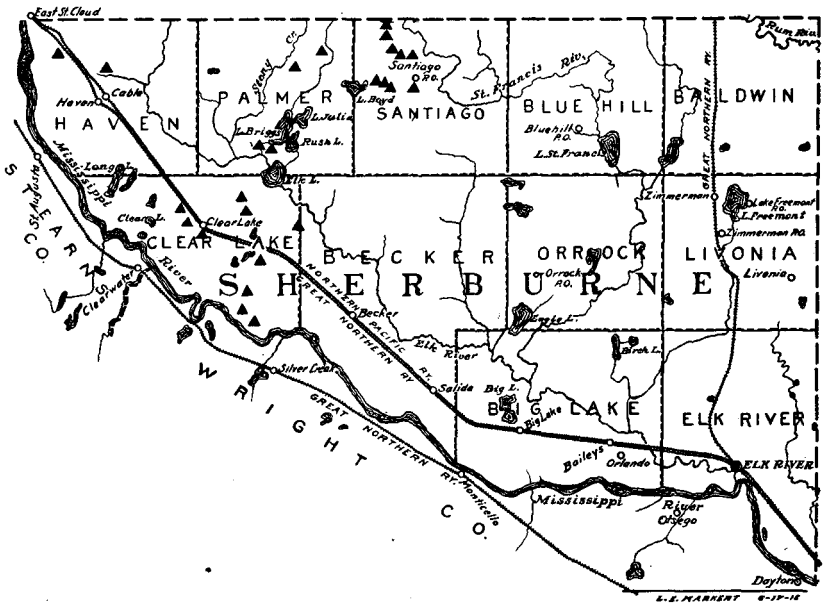


Fig. 4. Map of Sherburne County

The triangles show locations of tobacco-growing centers in 1910

from $4\frac{1}{2}$ to $7\frac{1}{2}$ cents per pound, f. o. b. Clear Lake. The price was relatively low on account of more or less damage by hail. The amounts sold do not represent the entire yield, as several kept some for home and other uses, and in one instance 3,400 pounds were destroyed by fire. Notwithstanding this, the gross receipts per acre range high, compared with the receipts for grain and other farm crops commonly raised. The smallest gross receipt per acre (\$5.22) was at the state reformatory, where the crop was practically destroyed by hail. The

TABLE I
STATEMENT OF TOBACCO GROWERS, 1910

Name	Address	Area in Tobacco	Amount Sold	Price per Pound	Amount Received	Amount Received per Acre	Remarks
Brown, H.	Clear Lake, R. 1	Acres $\frac{1}{2}$	Pounds 486	Cents 6.59	\$31.59	\$63.18	Small (weedy). Destroyed.
Cox, Sam.	Clear Lake, R. 2	$\frac{1}{2}$					
Davis, L. B.	Clear Lake, R. 2	6	5,767	5.50	317.18	52.86	3,400 lbs. destroyed by fire.
Eiliers, Fred.	Clear Lake, R. 1	$\frac{1}{2}$	355	5.50	19.52	39.04	Partly destroyed by hail.
Feuker, Jake.	Clear Lake, R. 1	$\frac{1}{2}$					Destroyed by hail.
Gillette, J.	Clear Lake, R. 1	2 $\frac{1}{2}$	1,898	5.50	104.39	52.19	Partly destroyed by hail.
Gilyard, J.	Clear Lake, R. 1	1 $\frac{1}{2}$	1,490	6.75	100.58	80.44	A little hail.
Gilyard, A.	Clear Lake, R. 1	$\frac{1}{2}$					
Heibel, E.	Clear Lake, R. 1	9	6,863	4.50	308.83	34.31	Kept 600lbs. to sweat. (Hail and frost, wet.
Hanson, J. E.	Clear Lake, R. 1	2	1,880	6.75	126.90	63.45	Good—fair.
Hardy, J.	Clear Lake, R. 1	About 100 plants					For own use.
Hardy, A. J.	Clear Lake, R. 1	About 100 plants					For own use.
Holland, F.	Clear Lake, R. 1	About 100 plants					For own use.
Kilgard, C.	Clear Lake, R. 1	$\frac{1}{2}$	370	6.00	22.20	44.40	
Lin & Puls.	Clear Lake, R. 1	5	6,540	5.50	359.70	71.95	Hail and wind.
Lipa Bros.	Clear Lake, R. 2	Small plot					For own use.
Mode, J.	Clear Lake, R. 1	Small plot					Sold to local farmers.
Neft, Andrew	Clear Lake, R. 2	Sold independently					A trial. 194 pounds reported, at 6 cents a pound.

*So nearly destroyed it was thought not worth while to try sale.

TABLE I—Continued
STATEMENT OF TOBACCO GROWERS, 1910

Name	Address	Area in Tobacco	Amount Sold	Price per Pound	Amount Received	Amount Received per Acre	Remarks
		Acres	Pounds	Cents			
Olsen, O. A.	Clear Lake, R. 1	$\frac{1}{2}$	697	6.50	45.30	90.60	Some hail.
Pink, C.	Clear Lake.....	3	2,904	5.50	159.72	53.24	Some hail, wct.
Peters, F.	Clear Lake.....	$\frac{1}{2}$	453	6.75	30.57	61.14	Some hail.
Peterson, H.	Clear Lake.....	$\frac{1}{4}$	} Neglected crop				No tobacco man.
State Reformatory	St. Cloud.....	5		475	5.50	26.13	5.22	Nearly all destroyed by hail.
Schindeldecker, J.	Clear Lake, R. 1	$\frac{1}{4}$	364	7.50	27.30	109.20	Very good, kept some.
Utz, F. E.	St. Cloud.....	$\frac{1}{8}$	217	5.50	11.93	95.44	Badly hail-cut.
Witcher, Wm.	Clear Lake, R. 1	1	*				Destroyed by hail.
Woods, C.	Clear Lake, R. 1	Few plants					A trial.
Total...		38 $\frac{1}{8}$				\$917.56	

*So nearly destroyed it was thought not worth while to try sale.

next smallest receipt (\$34.31), was from the largest acreage, where the crop was injured by hail and frost and was wet in the shed.²

The largest receipts per acre were from half-acre, eighth-acre, and quarter-acre patches, upon which the receipts on the acre basis were \$90.60, \$95.44, and \$109.20, respectively. The gross return on the crop from 38½ acres was \$917.43 or an average of \$24.06 per acre. This, according to the data on cost of production, would barely cover expenses. It must be taken into account, however, that an unknown quantity was kept at home, 3,400 pounds were burned, and the crop was badly damaged by hail. That the growers were inexperienced and the season was very dry, must also be recognized.

WORK OF 1911

The work of 1911 was taken up in the same manner as in 1910. There were 29 farmers, 15 of whom were new men, who grew tobacco on a total acreage about 20 per cent larger than that of 1910. The largest area grown by one person was 8 acres. The smallest areas were mere trial plots grown by inexperienced men, who harvested from 100 to 169 pounds. At stripping time the leaves were, in some cases, graded into assorting and filler grades; the rest was not separated into grades, but was classed as stemming and sold in bulk. The prices paid ranged from 3 cents for fillers to 9 cents for assorting; the average price paid for all tobacco sold was 6.21 cents per pound. The largest gross return per acre was \$165.88, received for a crop grown on a 1½-acre field. The least gross return was \$33.50, received from a crop grown on a half-acre plot. The average gross returns per acre, of all growers, was \$78.90. This was more than three times the average gross returns per acre of 1910 and was sufficient to leave a good net profit. A few varieties were grown for comparison and the cured leaves placed in storage for sweating.

WORK OF 1912

The work in 1912 was considerably more extended than that of the previous year. Heretofore all tobacco had been shipped from Clear Lake, but this year a carload was raised and shipped from Richmond, Stearns County. It was also ascertained that tobacco was being successfully and extensively grown in the southeastern part of the state; one man grew it successfully at Wahkon, Mille Lacs County, and a large corporation farm in Ottertail County grew a large crop.

The number of growers this year was 60, a 48 per cent increase over 1911. The combined area cultivated, exclusive of 10 small plots for trial, was 72½ acres. Thirty-six of the growers sold as in previous

² These instances are mentioned to call attention to the great risk encountered in producing a tobacco crop, and to substantiate the claim that tobacco-raising in Minnesota should be taken up only as a side line on a small acreage—not as the major enterprise.

years, the field agent receiving the shipments for the company. Of these the price received for the crops ranged from 3 to 10 cents per pound, according to grade.

The yields were on the whole better than formerly and ranged from 1,000 to 1,800 pounds. In general, the quality was better, presumably because the farmers were becoming better acquainted with the crop.

Some of the tobacco sweated in 1911 was given to two cigar manufacturers. Both parties made up cigars, filler, binder, and wrapper, exclusively of Minnesota leaf. Although the leaves had been sweated but one season, the many experienced smokers who tried them pronounced them very good. They burned well, with a whitish ash, were a little dark colored and of good flavor. One of the manufacturers stated that he would use a large quantity of Minnesota tobacco annually if it were sweated ready for use.

WORK OF 1913

The tobacco industry made great strides during 1913. Nearly a hundred acres, exclusive of trial plots, were devoted to tobacco-growing in the vicinity of Clear Lake and St. Cloud, and nearly 20 acres at Richmond. A total of 114 acres produced 144,689 pounds of tobacco which sold for \$89,708.18. The price averaged 6.2 cents per pound, with a range of from 3 to 10 cents; the 3 cents being paid for fillers and from 6 to 10 cents for stemming. The yields per acre on the whole were better than in other years. The highest yield was from a half-acre field which yielded at the rate of 2,100 pounds per acre and brought \$73.50, or a rate of \$147, gross, per acre. The lowest was from a field of 2 acres, which yielded 755 pounds and brought \$45.30 per acre. The average yield of the entire acreage at Clear Lake, Richmond, and St. Cloud was 1,269.2 pounds. The largest gross return per acre (\$152.19) was received from a 1-acre field. Of the 74 growers who raised tobacco in 1913, 25 received more than \$100 per acre for their crop and 11 received less than \$75 per acre.

In general, the season was favorable up to harvest time, when the unusually hot weather dried the leaves rapidly, instead of wilting the plants. The storing was unsatisfactory, for the crops were hung in all kinds of outbuildings, which do not have the necessary conveniences for the proper control of curing conditions. The unusually mild winter was in part unfavorable for the stripping and baling. Much of the crop was subject to mold and decay. These damages mostly occurred with the inexperienced growers.

An acre of land in the village of Clear Lake was rented for the purpose of trying a few practical ideas with reference to tobacco-growing. Connecticut Havana, Spanish Comstock, Silver Leaf, Bel-

gian, and Burley varieties were grown. The Minnesota Connecticut Havana grew the tallest and was the first one ready for topping. The Wisconsin Connecticut Havana was medium long. The Belgian grew well and had a medium sized, but thick leaf. The Spanish Comstock was a strong, robust grower, with a thin leaf. The Burley had a very large, broad, light green leaf and was low and spreading in character of growth. It ripened later than the other varieties. The Twist-leaf was similar to the Burley, but ripened ahead of the Connecticut Havana. These bid fair to be profitable varieties to grow in Minnesota for plug or chewing tobacco. They were heavy yielders and with seed selection would easily mature before frost in September. The tobacco was not marketed as early as it should have been to bring the best price. The farmers were undecided about the matter of selling until the early prices, which are usually the best, had dropped. The results were, however, generally satisfactory.

WORK OF 1914

The early spring conditions in 1914 were not favorable to tobacco. The weather was cold and the soil too moist for a favorable growth of the plants. The latter part of the summer, however, was very favorable and the crop came through without serious delay or trouble. Cutworms did considerable damage on late-plowed fields.³

There were 58 coöperators in 1914, of whom 20 were inexperienced. The area planted by individuals varied from half an acre to 10 acres and there was a total of 124 acres under the supervision of the field agent. Time records of stripping and baling were kept by two of the growers. One had 2 and the other 4 acres. Both had newly constructed sheds where the handling was convenient. The tobacco from the 2-acre field was piled, stripped, and baled in a total of 48 hours; that from the 4-acre field, in 124 hours. At the average cost per hour of man labor the former would cost \$3.35 per acre and the latter, \$4.28.

The fall season was ideal for harvesting. The crop ripened rapidly and was harvested in good condition. The crop from fields which were well manured and thoroughly cultivated was noticeably better than that from fields not so well cared for. "Casing" weather⁴ came the first week in December, but did not last long enough for the growers to get all their tobacco stripped and baled. The next casing weather did not come until the last of January and first of February. On March 6 all tobacco was ready for market.

A preliminary test of varieties was made at the state reformatory

³ See later page for remedies.

⁴ Casing weather is a mild, humid condition of the atmosphere when things in general will take on moisture.

farm, St. Cloud, for the purpose of studying the question of growing and making chewing tobacco. Different strains of the Burley variety were used. The so-called Yellow and Standup appeared to give best results, but as one season's work is insufficient to base definite conclusions upon, the work will be continued. Some of the varieties will be sweated and ultimately delivered to the state prison at Stillwater, where it will be made up for use. It is thought that the profit from growing this class of tobacco will be as good as from Connecticut Havana, for the reason that it yields about one-quarter more. Some of the Connecticut Havana will also be sweated to test further the value of the Minnesota-grown leaf for cigar-making purposes.

COST PER ACRE

No farm enterprise can be considered successful until it is shown that there is a margin of profit between the cost of production and the gross selling price. In investigating the production of tobacco in Minnesota, one of the first essential points to determine was the outlay in cash and labor necessary to grow, harvest, cure, prepare for market, and market the crop. Accordingly, in 1908 careful records were kept of both man and horse labor used in the culture of 8 acres of tobacco grown by a farmer operating a large farm at Clear Lake.

For convenience in estimating the possible adjustment of the time necessary for tobacco-raising with other farm enterprises, the data were kept distinct for each successive step in the work, from seed bed to harvesting. In studying the table of cost, therefore, the reader will bear in mind the relative distribution of time encompassed by each operation and correlate it with other, known, operations occurring at these periods.⁵ This will in a measure indicate the possibility of adjusting tobacco-growing into the system of farm management in vogue.

The approximate dates of the several operations are given in tabular form, that the relation with other farm work may be best observed:

Seed-bed management.....	April	5 to June	15
Preparing the land.....	May	1 to June	5
Transplanting	June	1 to July	5
Cultivating	June	5 to August	1
Topping and Suckering.....	August	1 to August	25
Harvesting	September	1 to September	15
Stripping and baling.....	December	1 to February	1
Marketing	Dependent on sale of crop		

⁵ The season, to a large extent, determines the range of dates for the several operations. Stripping and baling must wait for casing weather, which sometimes occurs in December, and again not until February, as was the case in the winter of 1914-1915.

TABLE II
COST OF GROWING 8 ACRES OF TOBACCO, 1909

NATURE OF WORK	TOTAL HOURS LABOR		RATE PER HOUR*		COST OF LABOR		TOTAL COST OF EACH OPERATION	AVERAGE COST PER ACRE
	Horse	Man	Horse	Man	Horse	Man		
Preparing seed bed	20	182.0	\$0.0941	\$0.1412	\$1.882	\$25.6984	\$27.5804	\$ 3.45
Transplanting.....	132	258.0			12.4212	36.4296	48.8508	6.11
Replanting.....		94.0				13.2728	13.2728	1.66
Field culture.....	441	414.0			41.498	58.4568	99.9548	12.49
Topping.....		40.0				5.648	5.648	.71
Suckering.....		59.0				8.3308	8.3308	1.04
Harvesting.....	155	542.5			14.5855	76.6010	91.1865	11.40
Stripping, baling and marketing†								
Total.....	748	1,589.5			\$70.3867	\$224.4374	\$294.8241	\$36.86
Estimated cost of preparing the land.....							\$28.00	\$3.50
Interest on land investment at \$35 per acre.....							16.80	2.10
Interest on machinery and the tobacco shed.....							20.40	2.55
					\$70.3867	\$224.437	\$360.0241	\$45.01

*The rate per hour was obtained from the 1909 rates per hour at Northfield, Marshall, and Halstad, statistical routes conducted by the Section of Cost Accounting.

†This account was not secured as the field assistant was not employed at the time the work was done.

COST PER ACRE

The time required in the preparation of the 8 acres for tobacco land in the following case was not obtainable, as it was plowed and otherwise prepared with the large field, of which it was a part. Therefore the cost per acre is approximately from \$3.50 to \$4 less than it would be were the cost of preparing the land included.⁶

The land values in the vicinity of Clear Lake at the time tobacco investigations started, ranged from \$25 to \$50 per acre.

Figuring conservatively that the value per acre of the farm upon which this 8 acres of tobacco was raised was \$35 in 1909, there is 6 per cent interest on the investment, amounting to \$16.80, or \$2.10 per acre. This figure also closely approximates the land rental value. A shed to accommodate the storing of the crop cost approximately \$300, and the transplanting machine, \$40. The interest on these investments amounts to \$20.40. No other equipment investment is included, inasmuch as the tools were already on the farm for use in other operations, and as no records of cost were kept on these it is impossible to apportion the cost to any one enterprise. No depreciation charge was made in this case as there were no figures available from which this could be deduced. By adding the interest on investments there is a total of \$37.20 for the 8 acres, or \$4.65 per acre. Adding to this the labor cost in the production of the crop (\$322.824) we have a total cost of \$360.024 charged to the 8 acres, or \$45 per acre.

COST ACCOUNTS IN 1910

In the year 1910 cost records were kept by three farmers who raised tobacco. One was an experienced tobacco grower; another had had one or two years' experience; and the third had had no previous experience in tobacco-growing. For convenience these will hereafter be designated as A, B, and C, respectively. A grew 8 acres; B, 3 acres; and C, 2 acres. The record of each enterprise was kept separate, as in the cost account kept in 1909.

The land values had increased on account of the successful production of tobacco; hence lands valued at \$35 in 1909 were now being sold for from \$40 to \$60 per acre, and in some cases higher prices were received. In figuring the interest upon the land values for the A, B, and C tracts, \$50 is taken as the standard. The investment is figured for A and a proportionate interest upon land values given B and C. These two, however, did not buy a transplanting machine, they borrowed from a neighbor.

Table III shows the cost of production to average \$17.694 per

⁶ This figure was approximated from the data reported by the Section of Cost Accounting, in Bul. 145, *The Cost of Producing Minnesota Farm Products, 1908-1912*, by F. W. Peck. There is no doubt that the land values have been abnormally increased, as a result of the successful growing of tobacco. At the present writing (1915) land worth \$75 to \$100 per acre is not uncommon. This, it is conceded, is more than its real value when compared with its producing capacity and land values generally.

acre, exclusive of interest upon permanent investment in land, machinery, and curing-shed. It is interesting to note that A's cost is \$15.266, B's, \$17.875, and C's, \$19.942 per acre. The low cost of production for A is partly the result of the larger acreage handled, but this can hardly be said to be an advantage of B over C. The main difference in the cost of production is due to experience in handling the crop. The greatest cost is in that part of the work in which man labor is used extensively, and where knowledge of the art lends adeptness to the individual, viz; in harvesting, stripping, and baling. On the other hand the increased acreage of A over B and C permitted better use of the labor in these operations. Other interesting facts are brought out in the cost-per-acre column in Table II. However, with tobacco-growing as with all other labor, a large measure of the success and profits depends upon the individual, as will be seen by comparing the costs of production of A, B, and C with the report for 1909, given in Table II.

In ascertaining the full cost of production for A, B, and C, it would be necessary to add interest on land investment, cost of shed construction and machinery, and depreciation. Without a complete farm inventory and accounting this is impossible. It may be assumed that where 5 or more acres are grown, a tobacco shed is necessary; with 4 acres or less it is altogether likely that some of the buildings already at hand could be used, thus more or less equalizing the average cost of production. The relative cost of shed-construction for small acreages would be more, for, as previously seen, the cost of growing is relatively more for the smaller acreages.

In approximating the total cost per acre of the tobacco grown by A, B, and C, the following figures are compiled:

Land value, \$50 at 6 per cent.....	\$3.00	interest per acre
Shed value, \$350 at 6 per cent.....	2.62	
Planter and other machinery, \$100 at 6 per cent .....	.75	
Lath and miscellaneous equipment, \$25 at 6 per cent .....	.19	
	<hr/>	
	6.56	
Horse and man labor.....	17.694	
	<hr/>	
Total cost	\$24.254	

The net profit per acre received by A, B, and C in 1910, was not as large as it would have been had not the crop been severely injured by hail and winds.

A received 5½ cents per pound or \$72.006 gross, per acre.

B received 5½ cents per pound, or 53.24 gross, per acre.

C received 5½ cents per pound, or 52.195 gross, per acre.

The difference in amounts received is accounted for by the different yields harvested, as the price received was the same in each case. This

TABLE III
SUMMARY LABOR REPORT—TOBACCO INVESTIGATIONS

KIND OF WORK	TOTAL LABOR		RATE PER HOUR		COST OF LABOR		TOTAL COST	COST PER ACRE	
	Horse	Man	Horse	Man	Horse	Man			
Preparation of seed bed.	Hours	Hours	Cents	Cents					
	A	7.75	60.50	.....	.....	\$0.6548	\$8.342	\$8.996	\$1.124
	B	3.25	26.50	8.45	13.79	.2746	3.654	3.928	1.309
C	5.00	23.75	.....	.....	.4225	3.275	3.697	1.848	
Preparing land.....	A	145.00	65.00	.....	.....	12.2525	8.963	21.2155	2.652
	B	60.00	30.00	.....	.....	5.07	4.137	9.207	3.069
	C	22.00	11.00	.....	.....	1.859	1.516	3.375	1.687
Transplanting.....	A	52.00	99.00	.....	.....	4.394	13.652	18.046	2.256
	B	22.00	51.00	.....	.....	1.859	7.032	8.891	2.964
	C	12.00	26.00	.....	.....	1.014	3.585	4.599	2.299
Field cultivation.....	A	120.00	87.00	.....	.....	10.14	11.997	22.137	2.767
	B	25.00	26.00	.....	.....	2.1125	3.585	5.6975	1.899
	C	22.00	19.00	.....	.....	1.859	2.620	4.479	2.239
Harvesting.....	A	36.00	185.00	.....	.....	3.042	25.511	28.553	3.569
	B	28.00	85.00	.....	.....	2.366	11.721	14.087	4.696
	C	20.00	82.00	.....	.....	1.69	11.307	12.997	6.498
Stripping, baling, and marketing	A	10.00	162.00	.....	.....	0.845	22.339	23.184	2.898
	B	6.00	82.00	.....	.....	.507	11.307	11.814	3.938
	C	8.00	73.00	.....	.....	.676	10.066	10.742	5.371
Total.....	A	370.75	658.50	.....	.....	31.328	90.804	122.131	15.266
	B	144.25	300.50	.....	.....	12.189	41.436	53.624	17.875
	C	89.00	234.75	.....	.....	7.520	32.369	39.889	19.942
Grand total.....		604.00	1,193.75	.....	.....	\$51.037	\$164.609	\$215.644	\$17.694*

*This item is exclusive of interest on land value, shed cost, and machinery.

leaves a net profit of \$50.289, \$28.974, and \$13.496, respectively, for A, B, and C.

These profits are very inviting and offer strong inducements for entering more extensively the tobacco-growing industry, but there is much to be considered before a farmer would be warranted in growing tobacco extensively, rather than as a side line. So far as Minnesota is concerned, tobacco-growing is an infant industry; its full success, although reasonably certain, is not assured. Certain areas are sure to be illy suited for growing a marketable crop; these are yet to be ascertained. In no locality will it likely be profitable unless at least

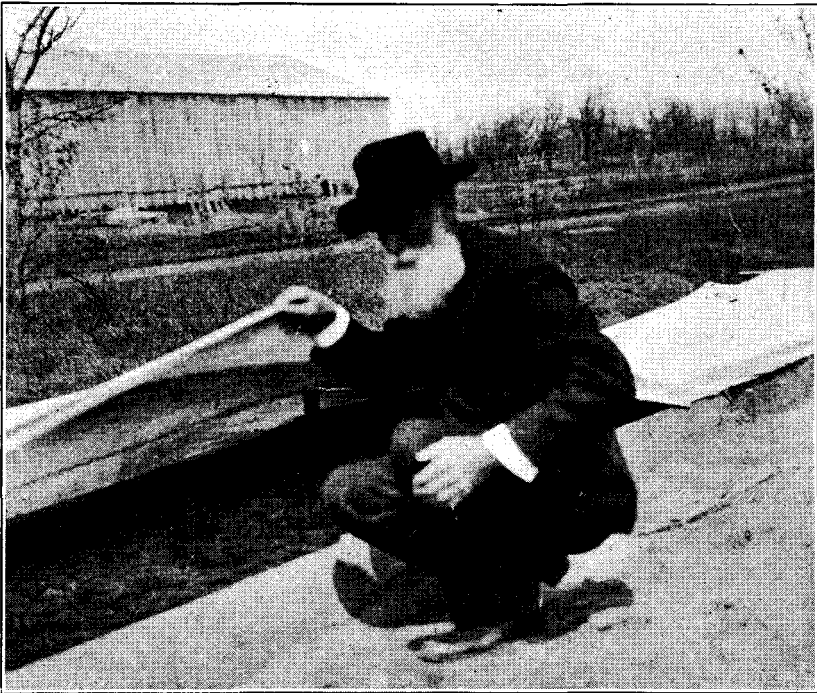


Fig. 5. The Seed Bed

The muslin cover is supported by a wire ridge-pole and fastened at the edge by catching over shingle nails driven through the outer corner of the frame.

a carload can be delivered to the shipping point. The plants are easily damaged and may be destroyed by hail and wind. Insects and disease will certainly visit Minnesota tobacco as soon as it is more extensively grown. The land must be heavily manured if a large, profitable crop is to be harvested. The several steps in its culture come at times of other important activities on the farm. There are no tobacco warehouses in the state—the market is all in Wisconsin. The prices are not certain and at present are less than for tobacco of the same grade bought in Wisconsin. Dealers could not give impetus to its culture by

advertising the use of a Minnesota product, for the reason that the trade supposedly demands a Wisconsin or foreign filler. These are some of the important points which prompt the advice to proceed slowly. On the other hand there may be the advantage of large returns from small areas; a point worthy of consideration by the small-farm owner. It is a cash crop, yet it is often six months after harvest before it is ready to sell. It is a crop which requires but little strenuous, or so-called "hard labor." On a basis of from 3 to 10 acres it will fit in well with mixed or dairy farming, poultry or fruits; in fact, as a side line properly cultured, it will fit in with any line of farming and prove profitable. It is marketed at a slack time on the farm and is not bulky.

CULTURAL DIRECTIONS

THE SEED BED—ITS LOCATION AND CONSTRUCTION

The tobacco seed is so very small and the plants are so tiny when first gaining a place in the soil, that it is necessary to start them under most favorable conditions. Protection from wind and weather, a perfect seed bed, and sufficient moisture must be carefully provided or the young plants cannot survive. Obviously, therefore, it would be impossible to grow the crop by planting the seed in the open field. For these reasons tobacco-growers always start the plants in a so-called seed bed.

The location for the seed bed must be decided upon and the land plowed or otherwise prepared in the fall preceding its use. Select a place that is well protected from winds, provided with sunlight, and convenient. Select a soil that is rich, clean, and well drained. Good under-drainage is of most importance in the seed bed. In most tobacco sections the beds are made on the surface of the ground.⁷

Some protection is always necessary for a cold frame upon which a covering of muslin or a hotbed sash is to be used. The frame may be made from 4 to 5½ feet wide and any length desired. If made more than 5½ feet wide the weeding of the bed is difficult.⁸ The sides and ends of the cold frame are usually made of 1x6-inch boards. For hot beds 1x10- or 12-inch boards are used. Across the corners and at about 6-foot intervals across the bed, 1x4-inch strips are nailed to give the frame additional strength. Usually 5- or 6-cent muslin will be sufficient as a covering, but hotbed sash, if at hand, may be used for two or three days to get the seedlings started, or longer if it is necessary to force the plants for early planting. It would not

⁷ Some have thought best to first make a foundation of from 6 to 10 inches of well-packed horse manure. The frame is then set firmly on this. Three or 4 inches of rich loam soil is placed on the manure and pulverized. Into the soil selected for the bed, there should be raked about 1 pound of dried and finely pulverized hen manure to each 3 or 4 square yards.

⁸ If the bed is made 5 or 5½ feet wide the double width of muslin will just cover it.

be well, however, to keep the glass on long enough to make the plants tender and thereby cause them to suffer when transplanted into the field. If the glass is removed during the day, for two weeks before transplanting, the plants will become hardy. Ventilating the bed, if under glass, is a very important matter and should be diligently attended to. The sash may be closed down at night, but must be raised at one end—much or little according to the weather conditions during the day. A thermometer should at all times be kept in the bed, if sash are used. When the muslin cloth is used a wire ridge-pole stretched taut lengthwise of the bed will be necessary to keep the cloth from sagging in the center. A stake under the wire every 4 to 6 feet is necessary to hold the center of the cloth 10 or 12 inches above the edge of the frame. When this is not done, water often collects and drips through, thus causing the soil to become too wet. At the sides, the cloth is fastened down by drawing tightly and hooking it over shingle nails which have been driven slantwise through the top edge of the side boards, the point of the nails projecting about one-fourth inch on the outside. These nails should be not over 12 inches apart. When the frame is set, it should be banked well with dirt or manure to keep out the wind.

In preparing seed beds year after year, it will be found necessary to sterilize the soil, unless the location can be changed each year or two. Burning has been found one of the best methods of sterilizing it. To do this stir the soil with spade or plow, then burn straw, brush, or wood on the area until the soil has been thoroughly heated.

SOWING THE SEED

Time to sow.—In Minnesota the seed bed should be made soon after the first of April. The seed should be sown by April 15, not later than April 25, to obtain best results. This will bring the plants into condition for transplanting about June 10.

Tobacco seeds are so small and hard to secure plants from, it is necessary to soak them in water for from 24 to 36 hours previous to sowing in the bed.⁹ This insures the moisture necessary for germination and gives a good stimulus to growth.

⁹A good way of soaking the seed is to put it in a cloth sack and submerge this in water for the required time. Then bury the sack in damp sawdust; stir it daily and keep it moist until the seeds show white sprouts plainly; from 4 to 6 days will usually be required. When sprouted, put a tablespoonful of the seeds in a sprinkling pot and add from 4 to 6 quarts of water to float them, stir freely and sprinkle on the seed bed. Use precaution in this so that they are not too thickly sown. One spoonful will sow from 8 to 10 feet in a bed 5½ feet wide. The seed will not have to be raked in.

Another method of soaking sometimes used is to place the seed in a dish and pour just enough water in the dish to cover the seed. After they have stood the required time, mix the seed in the proportion of one ounce to a gallon or more of wood ashes or sterile sand or loose dirt. Sow this carefully and evenly over the bed. One ounce should sow a bed 5 feet wide by 200 feet long. Corn meal or wood ashes is also good to mix with the seed as it is then easy to see where the sowing has been done. The seed should be sown on a quiet day, to avoid loss and uneven seeding. The surface of the soil in the bed must be made thoroughly fine and loose before the seed is sown. After sowing the seed the bed should be thoroughly sprinkled with water.

The bed should be kept moist at all times, but not soaked or the plants will "damp off." Immediately after the sowing, cover with the cloth or glass. Keep out all weeds by carefully removing them with the thumb and finger when they appear. When the plants have made a reasonably good growth, on bright days the cover should be removed for a short time in the heat of the day; and the time increased from day to day until it can be removed entirely, the weather permitting. In case of cold or snow after the plants are well started, or in

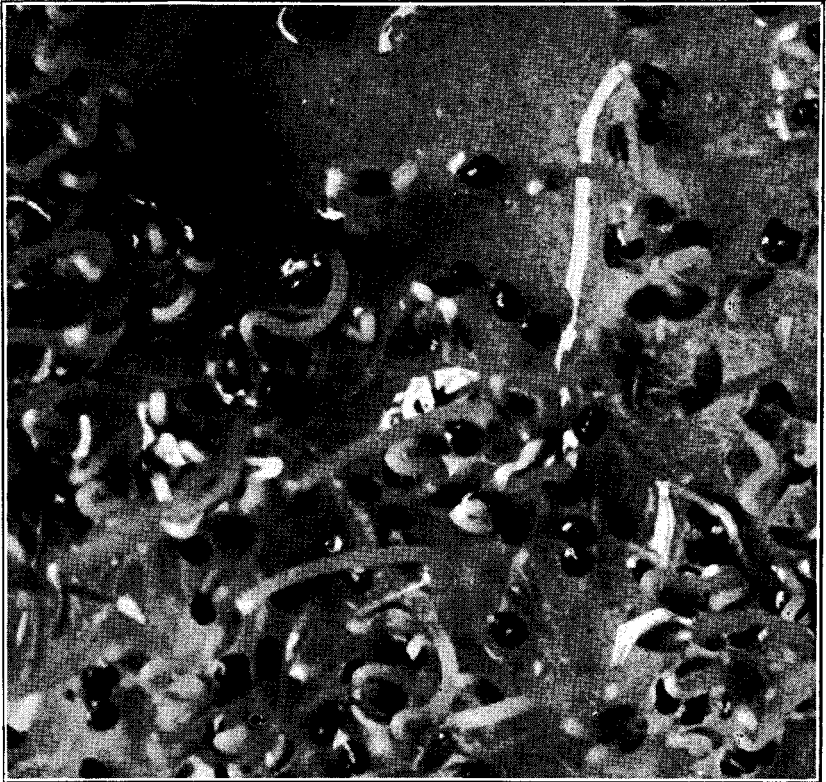


Fig. 6. Sprouted Tobacco Seed

The seeds are very much enlarged. Their natural size is about equal to the point of a common pin.

case of frost, lanterns may be placed under the canvas to prevent the plants from freezing. The plants, however, will stand considerable cold without being damaged. When glass is used there is less danger from freezing.

TRANSPLANTING SEEDLINGS THE SOIL

It is a well-known fact that tobacco will grow in any soil from

heavy clay to light sand, but the selection of soil suited to the growth of tobacco is very important, for upon the character and fertility of the soil depend to a large extent the value of the crop. The sandy or sandy-loam soils rich in humus are generally best suited for tobacco. It is vitally important that the soil contain a large amount of available plant food. Spring-plowed soils should be worked down to a firm condition to restore perfect capillarity between the furrow slice and the subsoil before the young plants are transplanted. This should be done by the subsurface packer (corrugated roller), the disk, the slant-tooth harrow, and the smoother or planker.

Fall plowing is preferred for many reasons, but chiefly because it reduces the danger from insects. Fall plowing also gives better control of weeds, as well as an opportunity to plow under the manure, which is acknowledged to be the best method of applying it. It also reduces the amount of work to be done in the rush of the spring season. If spring plowing is necessary, it should be done early to allow proper soil preparation and to kill weeds before transplanting the seedlings.

MANURING AND FERTILIZING

Fresh manures should not be applied in the spring. They should be applied and plowed under in the fall. Composted manure may be applied in the spring at the rate of from 12 to 15 loads per acre and plowed under fairly deep (five or more inches). It may be applied as a top-dressing on spring- or fall-plowed land if it is well worked in with a disk. Commercial fertilizers may be used to good advantage by those who understand them. On the other hand much damage may result from an improper use of commercial fertilizer. Some kinds are detrimental to the quality and production of the crop. Barnyard manure will in the long run prove most satisfactory. It is always at hand and not only has value as a plant food, but fills an important place in supplying humus, which is so necessary in controlling the physical conditions of the soil.

SETTING OUT THE PLANTS

While handling the plants during the operations connected with transplanting, one must observe a few points closely: (1) The plants should be from 4 to 6 inches in height. (2) Before pulling the plants, the bed must be thoroly soaked with water. This should be done from 1 to 3 hours before the plants are pulled to allow the soil to become thoroly saturated at least 2 inches in depth. (3) Pull the largest and best plants carefully without bending or injuring them in any way. (4) Place them carefully in a basket or box to exclude the sun's rays and the wind in order to prevent the roots from becoming dry. (5) Do not drop the plants ahead of the man who sets them out. The root systems are delicate and the plant, therefore, must have

every advantage in order to become well established and produce a profitable crop. (6) Too deep setting is injurious. (7) Set the plants 2 or $2\frac{1}{2}$ feet apart in the row and leave the rows $3\frac{1}{2}$ feet apart. On areas of one or more acres a transplanting machine is found economical. If the area to be set out is small, transplanting may be done by hand. For hand-planting a dibble is used for making a hole for the plant and in pressing the dirt firmly about the roots. A dibble is usually made of wood and is from 6 to 8 inches long, half an inch to an inch through and pointed on one end. (See Figure 7.)

In placing the plants in the soil by hand, first make a hole the

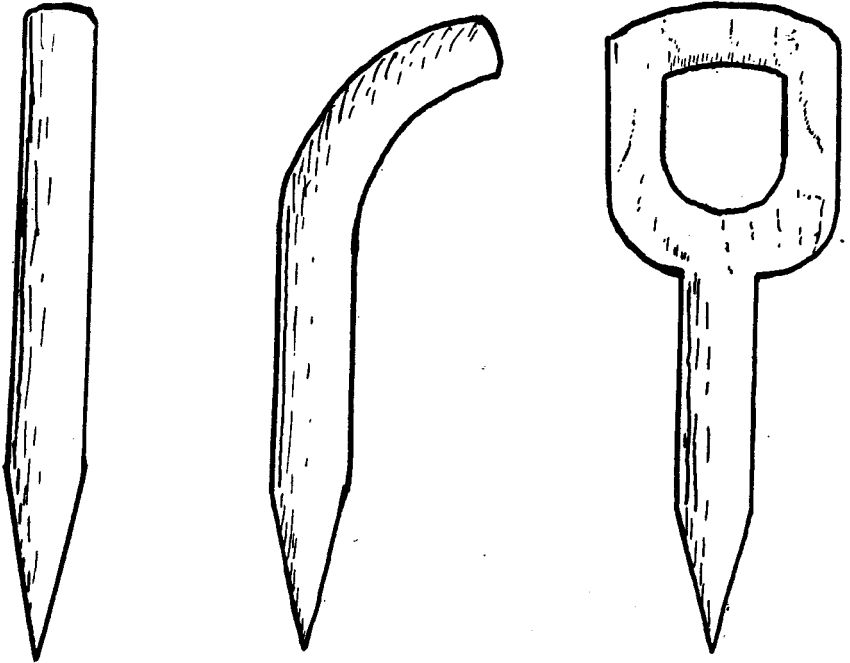


Fig. 7. Dibbles Used to Advantage When the Plants are Transplanted by Hand

proper depth with the dibble just as in transplanting cabbage, then hold the tobacco plant loosely in the fingers, the root end projecting beyond the finger tips just a little farther than the depth to which the plant is to be set. Now put the roots to the proper depth in the hole and push the dibble down beside the hole, the point slanting toward the roots of the plant; then by drawing the hand over, crowd the dirt up against the roots and stem of the plant. Now place one foot a few inches from the plant and by pressing downward and toward the plant

complete the firming of the soil. If a pint or so of water can be given each plant after it is set, its growth is quite certain. If the machine transplanter is used no special instruction is necessary. The driver is guided as in planting corn, by a mark. The two men with the plants alternately hold one at a time in place until the check opens the valve and drops the pint of water in the soil. The plant, released, falls into position, its roots in water. As the water is absorbed the soil settles firmly around the roots.

The time for transplanting tobacco in Minnesota ranges from June 1 to July 10. A crop may, under favorable circumstances, be obtained if the planting is done as late as July 15, but the earlier planting is recommended. Better results will be obtained if the transplanting is



Fig. 8. Transplanting Tobacco Plants in the Field

The two men at the rear place the plants alternately in the planter device. At regular intervals the plant is dropped and a pint of water is left at the roots of the plant.

done about June 20 and just before or after a rain. Without rain the planting is best done late in the afternoon. This gives the plants a chance to recuperate before the sun's rays become intense on the following morning.

For protection against grasshoppers and against damage by wind half a dozen rows of corn around the outside of the tobacco patch are necessary. If the area is large, two or more rows of corn running through the field every four rods will be necessary to prevent damage by wind. This corn, if convenient, may be of selected stock and cared for as a breeding plot for seed corn.

CARE OF TOBACCO IN THE FIELD
CULTIVATING

Tobacco plants will usually wilt after they have been set out in the field, but they will soon recuperate and become firmly established. As soon as they have recovered from the effects of the transplanting, cultivation should begin. A one-horse five-toothed cultivator is preferable for this work. Shallow cultivation is recommended. Owing to the very short time after transplanting in which the plants mature, it is essential that they get an early start. Hoeing to stir the soil and kill the weeds stimulates vigorous growth and is necessary for the production of large, thin leaves of good quality. The hoeing attachments for two-horse riding cultivators have proved very satisfactory and eco-



Fig. 9. Cultivating Young Tobacco Plants with the "Hoeing" Attachment

By means of this attachment the driver can throw the soil around the plants and at the same time do the cultivating between the rows. This device is also used extensively for cultivating cabbage and other market-garden crops.

nomical in stirring the soil immediately about the plants. The fields should be hoed once or twice during the season and cultivated once each week or ten days until the leaves are large enough to make the work difficult without injury to the plants. When the plants get so large as to be damaged by the ordinary cultivator, a surface cultivator, as shown in Figure 8, may be used. There is no danger of giving too much of the right kind of cultivation. On the other hand there is great loss in quantity and quality of the crop through lack of cultivation. The one thing to be constantly borne in mind in cultivating is the care necessary to prevent the leaves from being damaged. The

plants must be kept growing rapidly and continuously from start to finish. Frequent cultivation will insure this.

TOPPING

Topping, sometimes also called "budding", means the pinching or breaking out of the top of the plant to prevent the development of seed. If allowed to go to seed, a great deal of the strength of the plant is taken from the leaf development, for the formation of seed requires a great deal of nourishment. The topping is done when the plants are about 24 inches high. At this stage of development the plants begin to "shoot" the seed stalk. This seed stalk, together with the first two or three leaves, is removed in one of several ways. Some

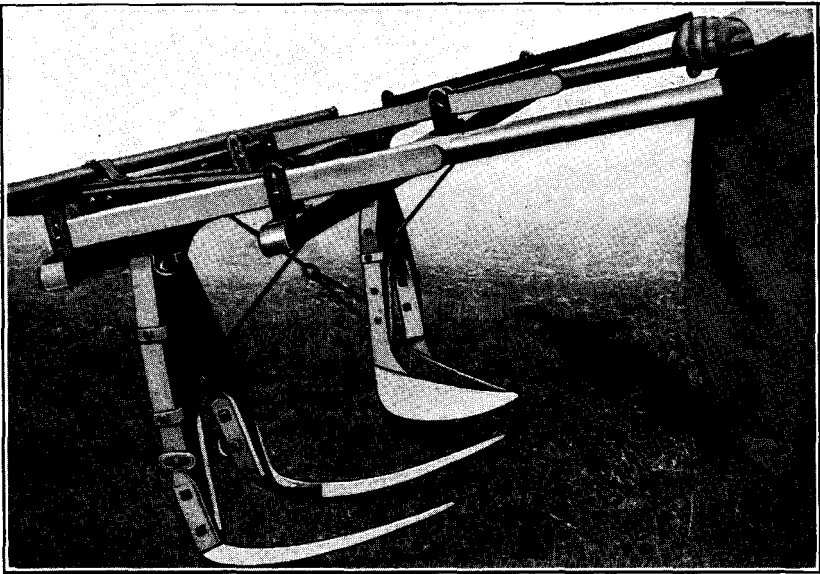


Fig. 10. A Surface Cultivator

This is used in the tobacco fields when the plants have grown so large that the ordinary cultivator would damage the leaves.

tobacco-growers prefer to wait until the first full blooms appear before topping; others prefer to pinch out the top when it is very young, small, and tender; and still others say any time before full bloom will do.

As the object of the topping is to throw the strength of the plant into leaf development and also to hasten the maturity of the leaf, the Minnesota growers are advised to top as soon as the seedheads are plainly visible throughout the field. It is generally considered best to cut the tops off with a sharp knife. As the plants will not be uniform in development, it will be found necessary to top some plants at a very

early stage in their growth. All plants should be topped at nearly the same date or the ripening will be uneven and cause inconvenience in harvesting or an uneven, inferior grade.

SUCKERING

After the tops are cut out, the tobacco plants put forth another effort to develop seed. This is done by sending out branch shoots at the axes of the leaves. These will come out on the upper end of the stalks first, then on down the stalk and finally from the base at the surface of the ground. The young shoots are termed suckers and must be removed to permit the best leaf development. The process of removing these shoots is termed "suckering." Owing to the fact that the shoots do not all start at once, the tobacco-grower must watch the patch closely and from time to time break off the suckers. The



Fig. 11. A Field of Connecticut Havana Tobacco Grown in Sherburne County

suckering must not be neglected. If the shoots are left too long they become tough and attached firmly to the stem and leaves, and when broken off will cause injury to the latter. At harvest time all "stragglers" must be removed. If left on they will continue growing and draw the food materials from the stem and leaves, thus injuring their quality.

INSECTS

There is little danger as yet in Minnesota from the ravages of insects, except perhaps from grasshoppers, cutworms, and grubs. But the tobacco-grower should at all times be watching for injurious insects. Aside from the grasshopper the tobacco or hornworm will do much damage. It and its work will always be known after once rec-

ognized for the worm is large, green in color, and has a horn on its posterior end. This worm feeds ravenously upon the leaves and always eats from the edge. The common cutworm is also known to do damage in newly transplanted fields. It works just at the surface of the soil and eats off the stem. Plants thus destroyed should be replaced at once by new ones from the seed bed.

The only remedy for the hornworm is to hunt for it and destroy it. Bran poisoned with Paris green and placed near the plants has been found very effective in reducing the attacks of cutworms. The following precautions will greatly reduce the ravages of grasshoppers. A half-dozen rows of drilled corn planted around the tobacco patch and two or three rows planted so as to checker the field every 100



Fig. 12. Seed Plants selected from the Field

or more rows will check their entrance to the tobacco. To guard further against their working on the tobacco plants, use of the so-called "criddle mixture" is recommended by the Station entomologists. This mixture is made from fresh horse manure, Paris green, and salt, in proportions as follows:

Horse manure	60 parts by measure	Mix well and add
Salt	2 parts by measure	water to soften, but
Paris green	1 part by measure	do not make it sloppy.

Small piles ($\frac{1}{2}$ pint) of this mixture should be placed from 25 to 50 feet apart in the tobacco field.

The so-called "Kansas mixture" is also strongly recommended as an insecticide. It is made as follows: Mix 20 pounds of bran and

1 pound of Paris green. Mix 2 pints of molasses, 3 oranges grated fine, and $3\frac{1}{4}$ gallons of water; then combine these two mixtures, stirring thoroughly and spread thinly over the field. This amount is sufficient for one acre.

The most effective blow that all farmers, especially those growing tobacco, can give to insects, is to practice fall plowing and to institute a crop rotation. There are other benefits aside from destroying injurious insects to be derived from fall plowing and rotations.

DISEASES

Very little is known concerning the diseases which may be detrimental to tobacco-growing in Minnesota. As yet no serious trouble has been reported, nor is any expected until the industry becomes more common. Tobacco wilt, mildew, and various "spot" diseases may occur, but no general remedy can be given here.

HARVESTING

EQUIPMENT

For harvesting tobacco the following equipment will be necessary:

- (1) A sharp hatchet or special tobacco hatchet for cutting the plants.
- (2) A tobacco spear for stringing the plants on the laths for hanging. This is made of steel about $1\frac{1}{2}$ inches wide, 2 inches long, and $\frac{1}{8}$ of an inch thick. On the short shank of this spear is soldered a heavy, 6-inch tin cap, which will admit a $\frac{1}{2}$ -inch lath. (See Figure 14.) The cap slants gradually from the spear shank up to the lath size, so as to offer little resistance in stringing.
- (3) A 2-legged wooden horse made of 2x4-inch lumber, 10 feet long, with two 3-foot legs nailed about one foot from one end. On this end is made a socket about 6 inches deep to admit and hold a lath while the plants are being strung. For convenience a rack is made at the side or on top of the horse to hold loose lath within easy reach.
- (4) Lath $\frac{1}{2}$ x2x48 inches for stringing the plants. The ordinary lath will do, but the $\frac{1}{2}$ -inch lath is better. One lath for each five plants to be harvested is required.
- (5) A tobacco rack for the wagon. This consists of two parallel pieces of 2x6-inch boards or a 3-inch tamarack or poplar pole 14 feet long, running lengthwise of the wagon and securely braced to the bed. These should be firmly supported at least 3 feet above the bed to keep the tops of the plants from striking the bed when the laths are hung. This sort of rack offers no damage to the tobacco while being loaded, hauled, or unloaded.
- (6) A tobacco shed, or other convenient place for hanging the "strings." These sheds are cheaply made of rough boards and poles, so constructed as to permit of easy hanging of the strings, and

with no extra cross ties to obstruct the free handling of the crop in the shed.¹⁰

The accompanying plan and specifications are recommended for a shed of small cost, easy to construct and adequate in every way for our present conditions.

PRECAUTIONS

In dealing with the tobacco plants, be careful at all times to injure the leaves as little as possible. Each bruised or broken leaf lessens the value of the crop. Don't cut the plants in cloudy or rainy weather or leave them out over night if there is danger of rain.

WHEN TO HARVEST

As tobacco nears the condition best for harvesting, yellowish spots appear on the leaves; and as maturity advances the veins become brit-



Fig. 13. Cutting the Plants at Harvest Time

tle. As all leaves do not yellow at the same time the farmer will have to use his judgment about when to cut the plants. As a rule the plants are harvested when the majority of the leaves have more or less yellow spots. Do not allow the leaves to age too much in this way before harvesting is commenced. The lower leaves will mature first and the top ones last. Some idea of harvest time may be had from the time it takes from topping to harvest, which in Sherburne and Stearns counties is from 18 to 25 days.

All suckers, which spring from the base of the leaves, *must* be

¹⁰ Write to the Supt. of Documents, Government Printing Office, Washington, D. C., enclosing 20 cents, and ask to have Bulletin No. 143, B. P. 1, Principles and Practical Methods of Curing Tobacco, by W. W. Garner, sent to your address at once. This bulletin contains many illustrations which will aid in understanding the directions.

broken out before the plants are hung in the shed. Suckering can be done in the early morning, even while the dew is on, but the plants must not be harvested while wet with dew or rain, for the sand and dirt will then adhere to the leaves and lessen their value. Sucker enough plants each morning for that day. If suckered more than three days in advance, they will sprout again and cause extra work.

CUTTING

Use the hatchet dexterously so as to cut each plant off close to the ground with one stroke. Bend the plant over slightly to one side so as to expose the stem before cutting. Lay the plants carefully in wind-rows. For convenience in piling or bunching the plants, lay the butts



Fig. 14. Piling or Bunching the Plants

This is done after the plants have been cut some time and have wilted.

of four rows one way and the next four rows the opposite way with butts facing in. Allow the plants to remain in this way until they have wilted. From one to four hours, according to the weather, are usually required. On this account it is not advisable to cut more than can be handled easily in half a day. Do not let the plants wilt too much, or the leaves become dried and break with the handling. They will also become sunburned on hot days. For these reasons pile the plants as soon as wilted.

PILING

The plants are piled (bunched) in order to save labor in the next operation (stringing). Always handle the plants by the butt of the

stalk. It injures the leaves to grasp them by the middle. Lay the butts all one way and even. Do not pile the plants too deep as the pressure may injure the under ones. From thirty to forty plants in broad piles is found most convenient.



Fig. 15. Spearing, or Stringing the Plants on Lath, Preparatory to Hauling to the Shed

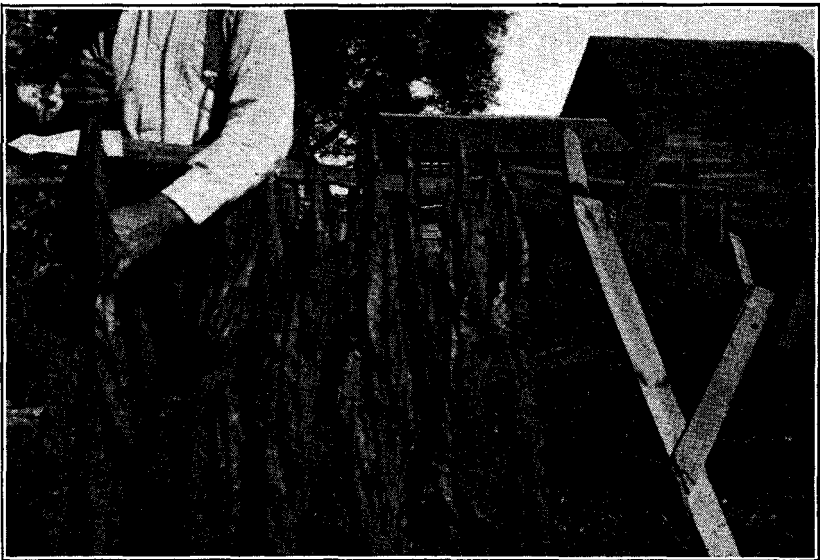


Fig. 16. Tobacco Spear and Manner of Holding the Plant
Note the "horse" and the saddle for holding the lath.

STRINGING

Bring the wooden horse up to the butt side of the pile, place a lath in the socket and the spear on the other end of the lath. Take the

butt of a plant in one hand and grasp the stalk with the other hand about ten inches up the stalk. Now stand close to the middle of the lath and with a "draw-shave" motion spear the center of the stem about five or six inches from the butt. Pull the plant onto the lath



Fig. 17. Loading Strings on the Wagon Rack



Fig. 18. Tobacco Harvest Scene Showing the Several Operations—Cutting, Spear- ing, and Loading

Note the cross rows of corn for protection against the wind.

and leave it about six inches from the lower end. In this way string from five to seven plants, according to their size, on each lath, leaving plenty of room between plants for air to circulate. Lay the strings

down carefully, one above the other, butts all one way, ready for loading and hauling.

HAULING

There are no difficulties connected with the hauling from the field. The strings are picked up and handed to the man on the wagon, who places the ends of the lath on the sides of the rack. This swings the plants free beneath and between the frames. The driver must go slowly to prevent the jostling of the plants. Handle the strings carefully to prevent the leaves from brushing against the legs of the rack.

HANGING IN SHEDS

The poles in the sheds should be just far enough apart (36 to 42 inches) to catch the ends of the lath. Commence near the end wall

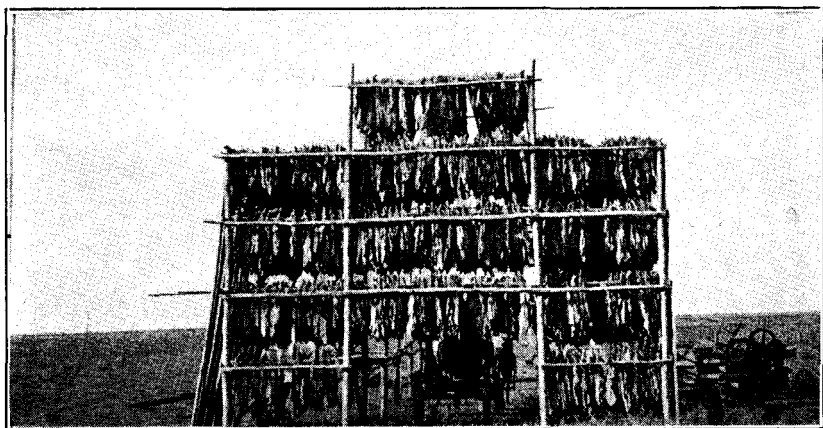


Fig. 19. Interior Frame Work of a Tobacco Shed Showing the Strings Hung for Curing

The shed was not completed when the crop was ripe. It was therefore hung in this manner and the shed constructed afterward.

on the top poles and lay the strings carefully one after another toward the center of the shed. Leave enough space (6 to 12 inches) between the strings to admit of a free circulation of air. When the top poles are filled, work on the next pair beneath and so on, always working toward the center and bottom of the shed until the crop is in. Two to four men can work to best advantage in housing the crop, especially if the house is large. One man can do it if given time.

Care must be exercised at every operation to prevent injury to the leaves. Keep the house closed on hot, dry days, perhaps opening it at night, to prevent too rapid curing or drying out. Shut all doors and ventilators during storms to prevent injury from rain or wind.

MATERIAL FOR SHED, AND COST

Capacity 7 acres

The following is a list of the materials used in the construction of a tobacco shed 112 feet long and 26 feet wide, with 12-foot sides and 16-foot rafters:

LUMBER

2,000 ft. 2x6, 14, 16, and 18 feet long.....	\$ 53.00	
5,666 ft. 1x8, 10 to 12 foot boards.....	145.10	
4,000 ft. 1x10, 16 foot roof boards.....	108.00	
110 pieces of O. G. battens.....	7.00	
		\$313.10

HARDWARE

50 lbs. 8d common nails	\$ 1.50	
25 lbs. 20d common spikes .....	.75	
10 lbs. 40d common spikes .....	.30	
6 pairs T 6-in. door hinges at 10 cents.....	.60	
80 pairs 6-in. strap hinges at 3 cents.....	2.40	
		5.55

PAINT AND ROOFING

5 gal. paint	\$ 4.75	
3 gal. linseed oil	2.25	
9 rolls roofing, at \$2.....	18.00	
		25.00

Total		\$343.65
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LABOR

In the construction of this particular shed no account is taken of the tamarack poles cut from the wood lot on the farm, and used exclusively for the frame work of the shed. These consisted of 18 for stud-ding posts, 18 for roof and hanging-frame posts each side of the center drive, and all hanging-frame supports and brace poles, which if purchased in dimension lumber, would be as follows:

20 pieces 4x4, 12 ft., for studding
18 pieces 4x6, 20 ft., for center posts
71 pieces 2x6, 10 ft., for hanger frames
200 pieces 2x6, 14 ft., for hanger frames
16 pieces 2x6, 18 ft., for braces

This would increase the cost approximately \$100; thus making the total cost about \$450, which is as cheaply as a tobacco shed of the stated dimensions can be built.

It will be noticed in the picture of the shed that the boards run up and down, which permits of each fourth one being hinged to serve as a ventilator. The 2x6, upon which the boards are nailed, are spiked on the stud-posts four feet apart, thus forming the side frame. The roof frame is made of 9 pairs of 2x6 rafters set over the stud-posts; a 2x6 ridge board and four other 2x6 cross ties between the rafters, that the roof boards may be nailed in 5 places. The end frames, exclusive of the doors, are formed in a similar manner as

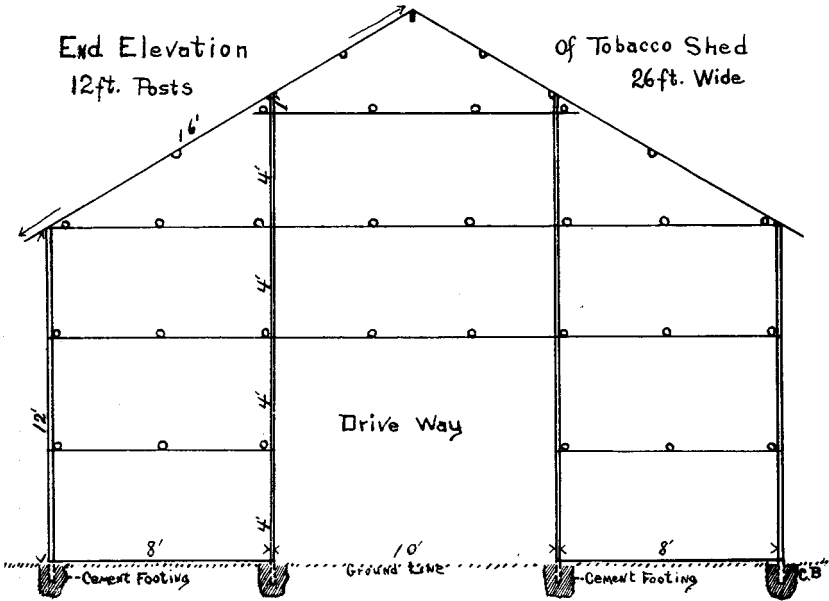


Fig. 20. End Elevation of a Tobacco Shed

The posts, the frames, the poles for hanging the lath, and the cement footings are shown.

the sides. The hanging-frame construction in each bent is well shown in Figure 17.

In addition to the above it will be necessary to brace the frame work securely in each direction. The studding and center posts should be securely set in cement at least one foot deep.

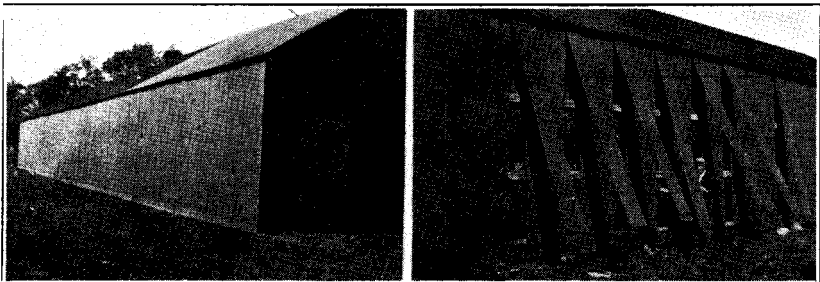


Fig. 21. Tobacco Shed

- A. The general form
- B. The ventilator boards on the side and the manner of opening them

CURING

The proper curing of tobacco by the air system depends on favorable weather conditions and proper shed construction. If the curing

season is favorable, shed construction is not so important, but the grower cannot depend on the curing season being favorable year after year. Two or three days of unfavorable weather may be enough to do a great deal of damage to the tobacco, if the shed is not so constructed that the humidity can be controlled.

THE SHED

In constructing a shed, it is not desirable to have the width greater than thirty feet, as the central hangers will not get enough air; 26 feet is regarded as standard width. The length should not be much over 100 feet, for if too long it cannot be filled rapidly enough, and the first

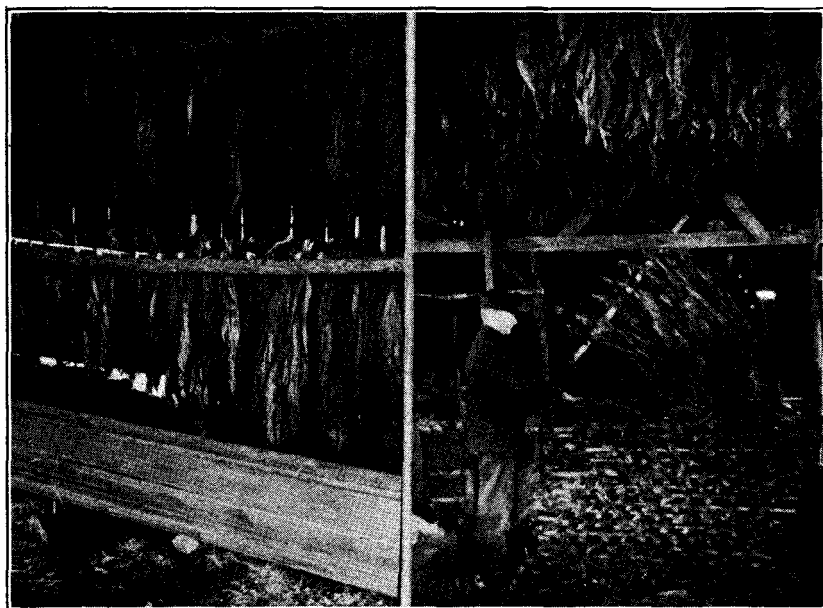


Fig. 22

Strings of Tobacco in a Curing Shed

Piling the Strings

tobacco hung in the shed will have passed through the first stage of curing before the last load is hung, thus making the proper regulation of the ventilation a difficult matter. A shed can be made any height, but one with 12- or 16-foot studs is considered the most convenient.

Ventilators on the sides of the shed are necessary, to open or close as the weather varies from humid to dry and the tobacco is green or dried. Two general plans for ventilators are in use. The easiest and cheapest to construct is the vertical type, as shown in Figure 21. No extra sawing, fitting, nailing, or figuring is necessary as will be seen from the discussion under shed construction. The horizontal type is

placed at the interval between the plants when hung on the frames in the shed for curing. This type is said to have the advantage of not permitting the air to enter direct upon the leaves, which on windy days when the plants are thoroughly dry will damage them.

The end doors may be used as ventilators at certain times if the farmer observes closely the need of more or less air circulation. Cupola ventilators may also be used to advantage under certain conditions, but with the shed construction as recommended and as illustrated in Figure 20, it is not necessary.

The roof must be waterproof and the sides sufficiently close to exclude all rain or snow. Water on the crop when in the shed will spoil the leaves and make them worthless.

CARE

The tobacco is hung six or more inches apart on the poles for the purpose of air circulation, which is necessary to the proper curing of the leaf. Be sure to open the ventilators during the first twenty-four hours. Do not open ventilators on hot, dry days, or in excessively windy weather, or during damp weather. The curing process during the first stage should be as slow as possible to prevent the leaves from losing too much oil, but the drying should be a continuous process. When the leaf has become a light yellow the first stage of the curing is finished. The second, or coloring stage, is very important. The "cigar" leaf should not be too dark or too light. This stage can be carried on more rapidly than the first stage. If a light-colored wrapper is wanted the ventilators should be used (except in cases named above), in order to finish quickly, and all moisture should be excluded. Too much moisture during the second stage produces a dark-colored leaf.¹¹

The relative amount of moisture in the leaf may be noted by its crisp and stiff, or flexible and soft condition. When in the former condition it breaks readily and must not be handled, whereas in the latter condition it is tough and can be handled or inspected without serious danger of being injured.

When the midrib of the leaf is dry enough that it breaks upon bending the leaf, or when it has lost all of its "green" or growing moisture, it is said to be cured. Another indication of the cured condition of the leaf is the absence of any green color, except perhaps at the very base of the midrib.

¹¹ In case of a rainy season of 3 or more days it is often necessary to build fires in the sheds to prevent "shed burn" and "pole rot." Open fires are objectionable, however, as the smoke affects the aroma of the leaf. The flue system is rather expensive and is not generally used in curing cigar wrappers.

CASING

When the plants are cured they are ready for stripping and preparing for market. But it will be necessary under Minnesota conditions to wait for casing weather before the stripping can be done. Under such conditions the tobacco leaves will take on moisture and become leathery and hence easy to handle. The casing may not come for some weeks. Frequently it occurs in January, but, as soon as it does occur, the leaves should be stripped, baled, and stored where they will not freeze.

STRIPPING AND BALING

There are two methods of stripping tobacco. The first consists in pulling the stalks off the lath before the leaves have been stripped.



Fig. 23. Stripping and Baling the Leaves

The plants are then picked up one at a time in one hand, while the leaves are picked off with the other hand. In the second method the laths or strings are placed in large piles, the lath forming a five-sided figure (pentagon). A socket or frame into which the ends of the lath will fit is fixed about three and one-half feet from the floor of the shed. The lath with the plants is then inserted into it, so that the plants hang with the tops down. Both hands can then be used for stripping. The second method is now more popular, as it is more rapid. The advantage in the former method is that the tobacco when bulked,

after taking it from the poles, will hold moisture better if the laths have been removed.

It is customary to separate the tobacco into two grades when stripping, i.e., fillers and binders. The fillers are first picked off and gathered into "hands" (a hand is the leaves secured from the stalks on one lath) and then packed in the bale. After the fillers have been removed the good leaves are stripped off and baled separately without being tied. If a number of the leaves have been damaged by wind or hail to such an extent that they cannot be graded as binders and yet are too good to be placed with the fillers, the crop may be divided into three grades instead of two, i.e., binders, seconds, and fillers. The seconds will include all leaves which have been damaged, but are too good for fillers. At the present price, however, it will not pay the average tobacco-grower to grade even into two grades, unless it be to eliminate badly damaged leaves from the binder grade.

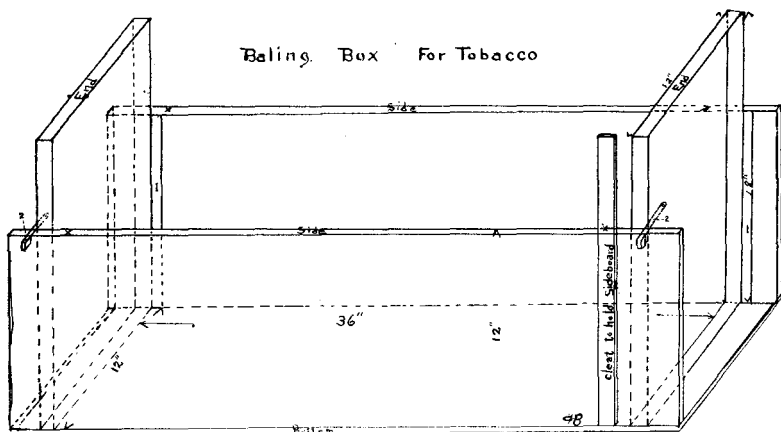


Fig. 24. Baling Box

A box form is used for the baling, in order to secure uniformity and evenness. The dimensions may vary, but the length is generally from 32 to 36 inches, height and width 12 inches each, inside measurement. The ends of the box should be 6 or 8 inches higher than the sides. Detachable boards 6 inches wide are used on the sides after the wrapping paper for the bale has been placed in the box. Three or four strings for tying the bale must be laid in the box before the paper is placed. For convenience and the safety of the short leaves in baling, one or more 2x12x12-inch planks may be used as false ends to shorten the bale. When the box is filled to the top of the side boards, pack down with a heavy plank cut to fit inside the box. Then fill up again and pack down. The amount of pressure to be applied to each bale

will depend on the moisture condition of the leaves. In general, the bales should be made to weigh 45 or 50 pounds. As soon as the bale is of the desired size, take off the side boards, lap the paper over the top and tie the strings as quickly as possible, before the leaves have a chance to spring up again. Two boxes should be used, one for fillers and the other for binders.

In placing the leaves in the bale great care must be taken to lay them straight. The leaves should not be twisted together or placed so that they will nearly stand on end in the box. First lay a hand in the two corners of one end of the box and one hand between these two to bind them. The base of the leaves must be tight against the end of the box. These hands will cover the bottom of the box. Then place



Fig. 25. Hauling Bales to the Depot

The farmers must deliver their bales all the same day, as the buyer ships in carload lots.

a layer of three hands in the other end of the box in a similar manner. Continue to place layers of three hands each alternately in either end. The tips of the leaves will be in the center of the bale and should overlap at least four inches in order to keep the center full and prevent the bale from breaking in two. Thus it can readily be seen that the length of the leaf will also determine the length of the bale. In baling fillers, it will be found necessary to bind the end layers with layers in the middle, as the filler leaf is very short. As fast as the bales are made, they should be piled three deep in a somewhat damp place. If piled higher than this, there is too much pressure on the lower bales.

MARKETING

Usually the buyers from the wholesale houses come around to see the crop and quote a price which will be paid f. o. b. at the shipping point. As there is little competition among the buyers, the farmer usually gets from any about as good a bid as is obtainable, but he is not obliged to sell in this way. He may send samples of his crop to various houses and get other quotations, or he may pack the crop in boxes for sweating and further curing. This will take at least a year, but a much better price is received for the cured leaf. Some danger



Fig. 26. A Field of Tobacco in Hubbard County
This was grown by a new settler, who appears in the picture.

of damage also attends the crop during the sweating. As the marketing of the tobacco crop is a difficult and serious matter, the farmers should study it carefully and at the same time cooperate with each other in the disposition of the crop. The delivery to the shipping point is made all the same day, as the buyers ship in car lots and demand delivery in the shortest possible time, in order to save expense and unnecessary delay. When hauling to the depot the bales should be covered with canvas or blankets to prevent drying.